

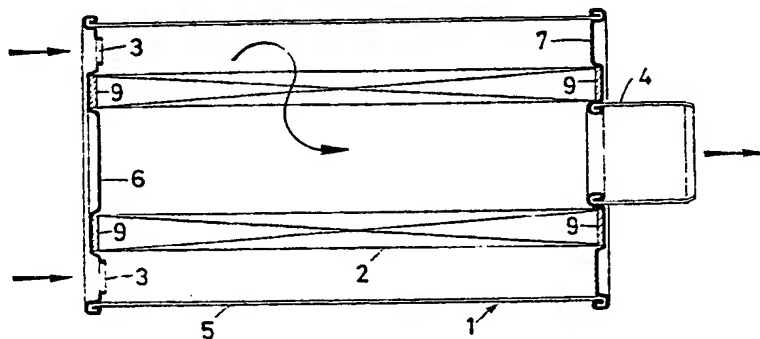
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GB 1131582
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(54) Disposable air filter

(57) An air filter for an I.C. engine has a casing, comprising a tubular body and two end plates, which is entirely assembled by crimping. One end plate is pierced with one or more air inlets 3 and on the other end plate is crimped an outlet nozzle 4. The filter cartridge 2 is gripped between the end plates. Such a filter, which is not dismountable and is inexpensive, is thrown away when clogging occurs.

The cartridge 2 may have various internal supports. The end plate 6 may have a single central inlet, in which case an internal plate supports the adjacent end of the cartridge. Inlets may be formed by punched out tabs which induce rotation of the air to effect centrifugal separation of dust, in which case the casing has a dust outlet in the form of a rubber valve or a nozzle connected to a venturi device. Cartridge 2 may be cylindrical or frusto-conical.

FIG. 1



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FIG. 1

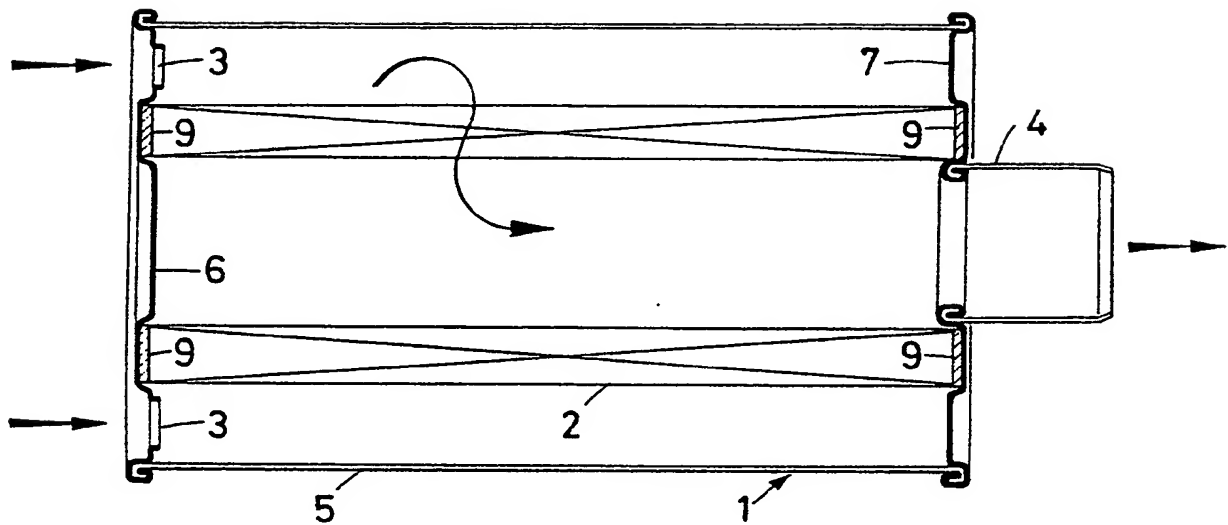
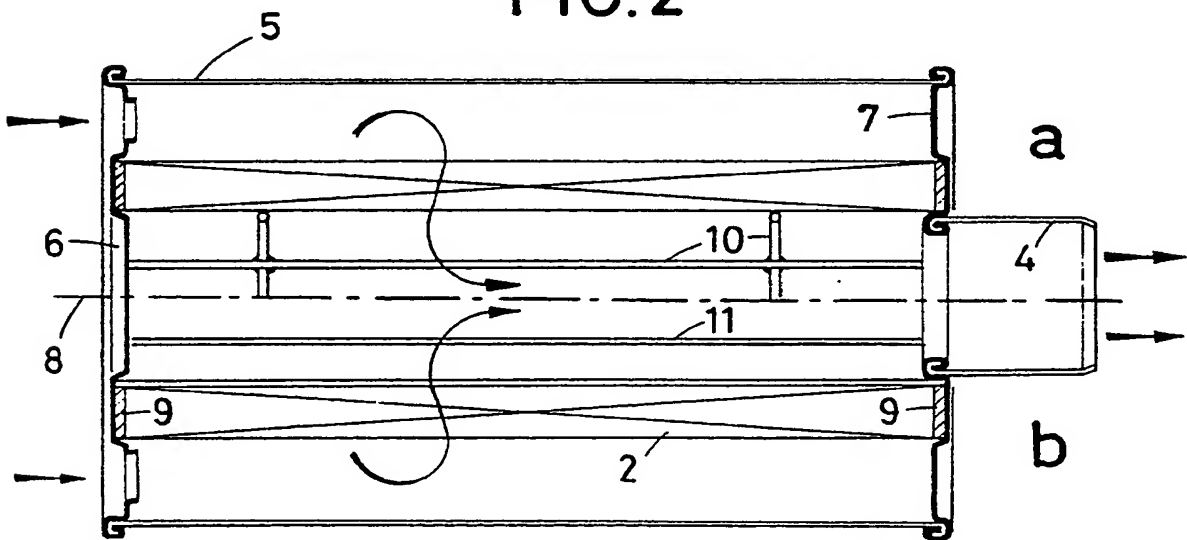


FIG. 2



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FIG. 3

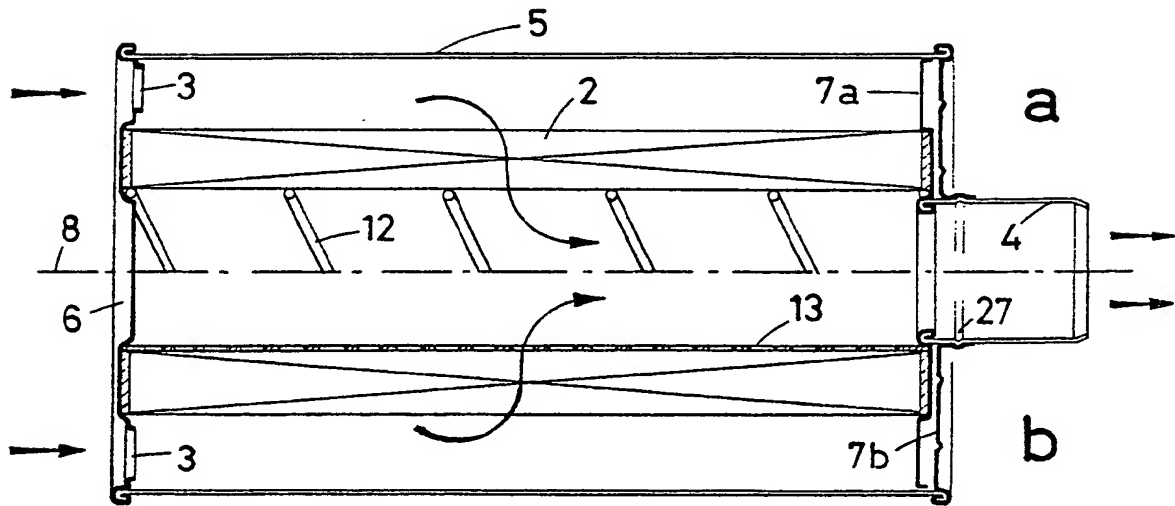


FIG. 4

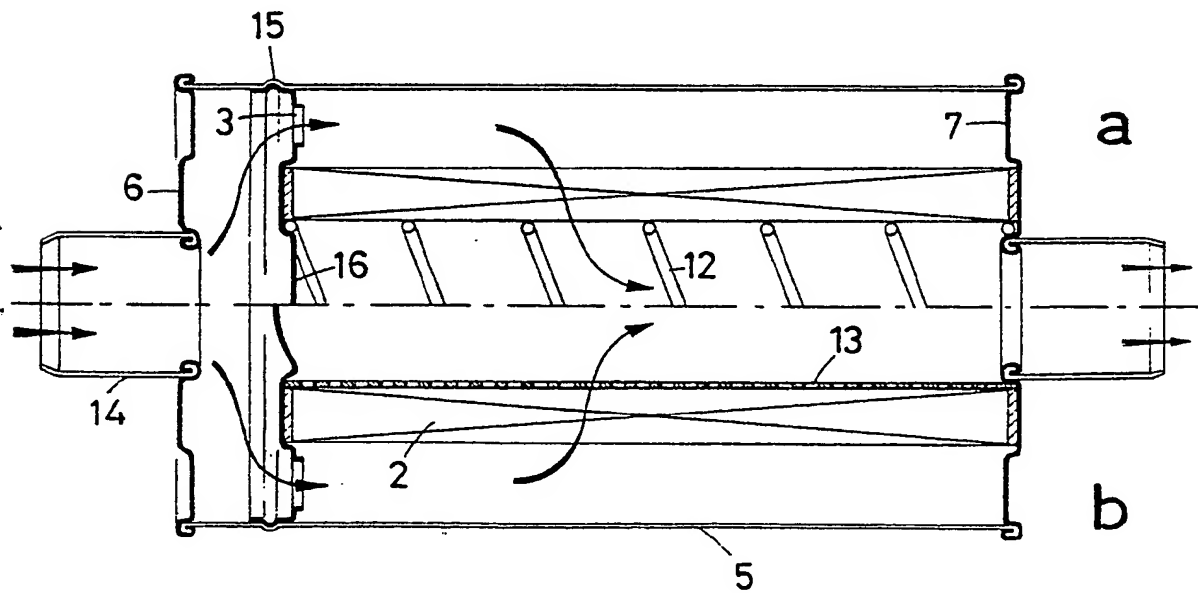


FIG. 5

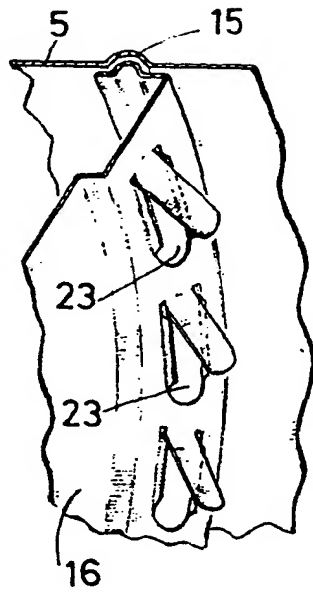


FIG. 6

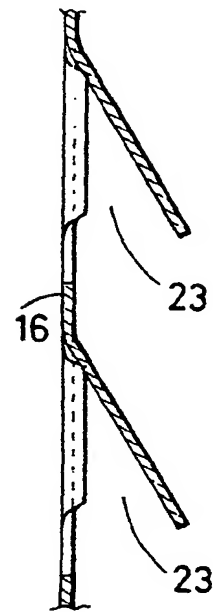
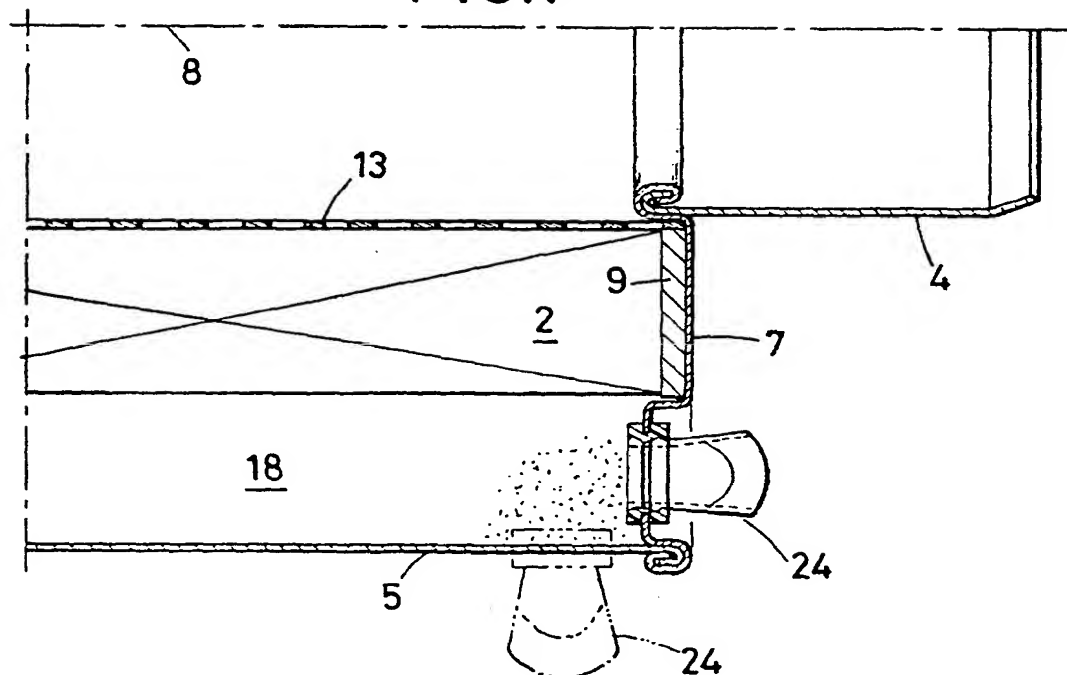


FIG. 7



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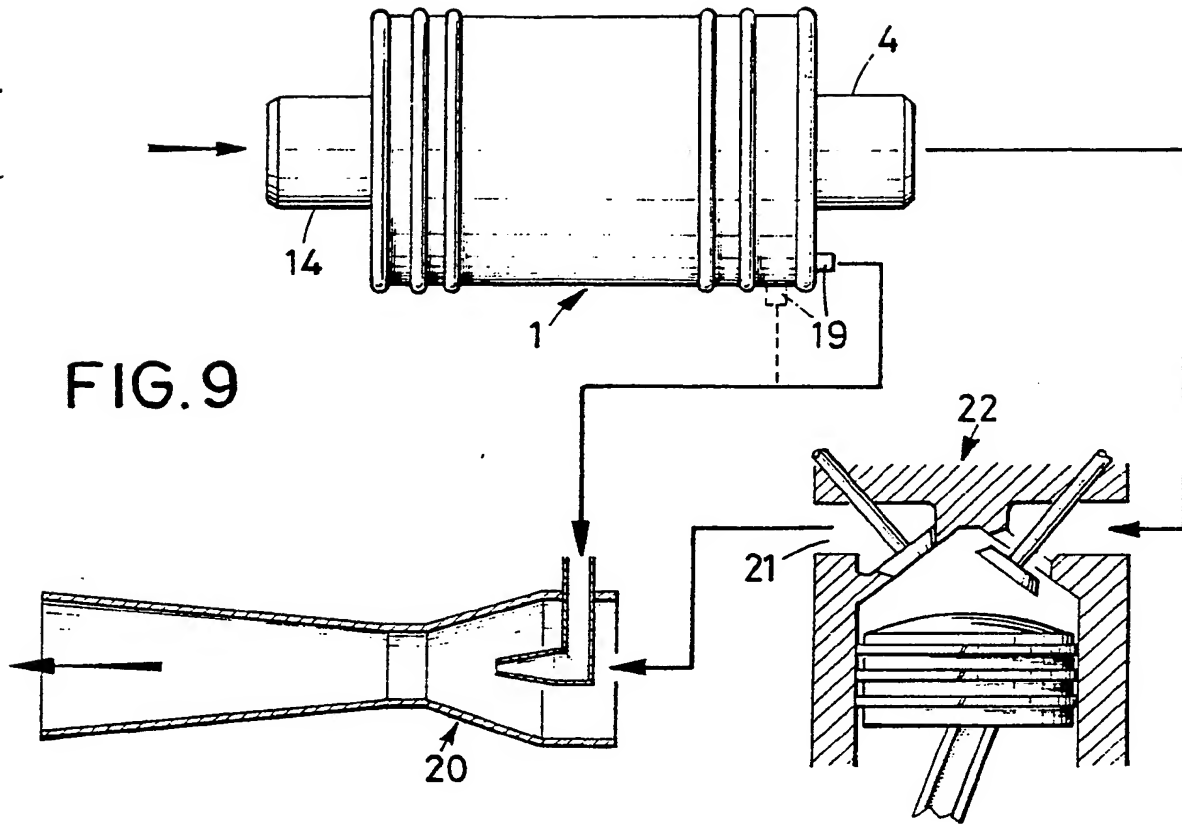


FIG. 8

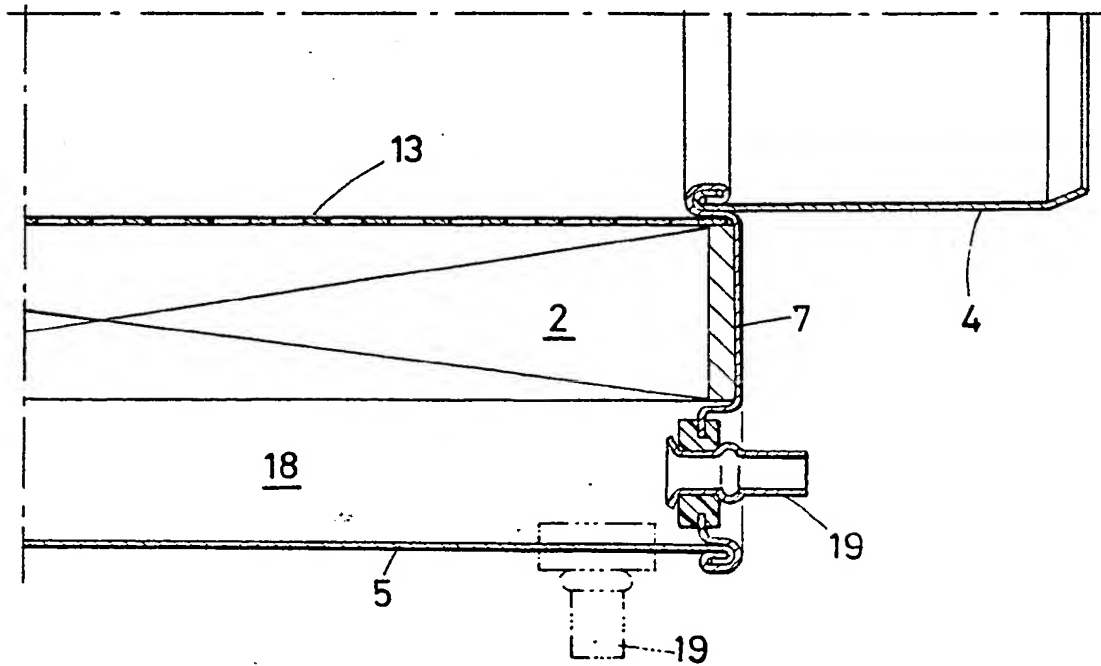


FIG.11

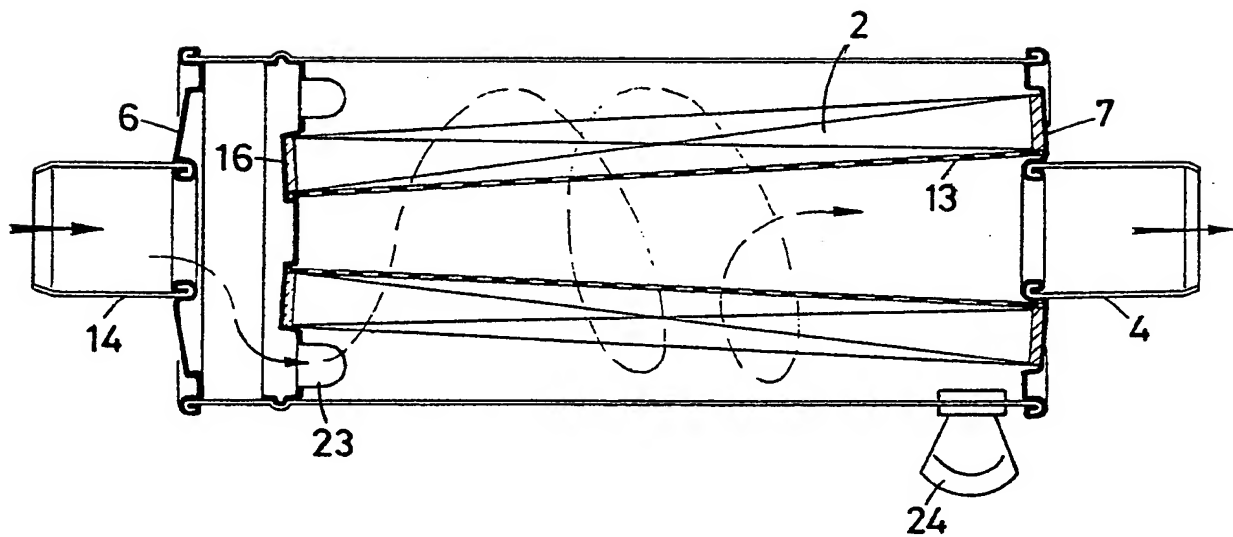
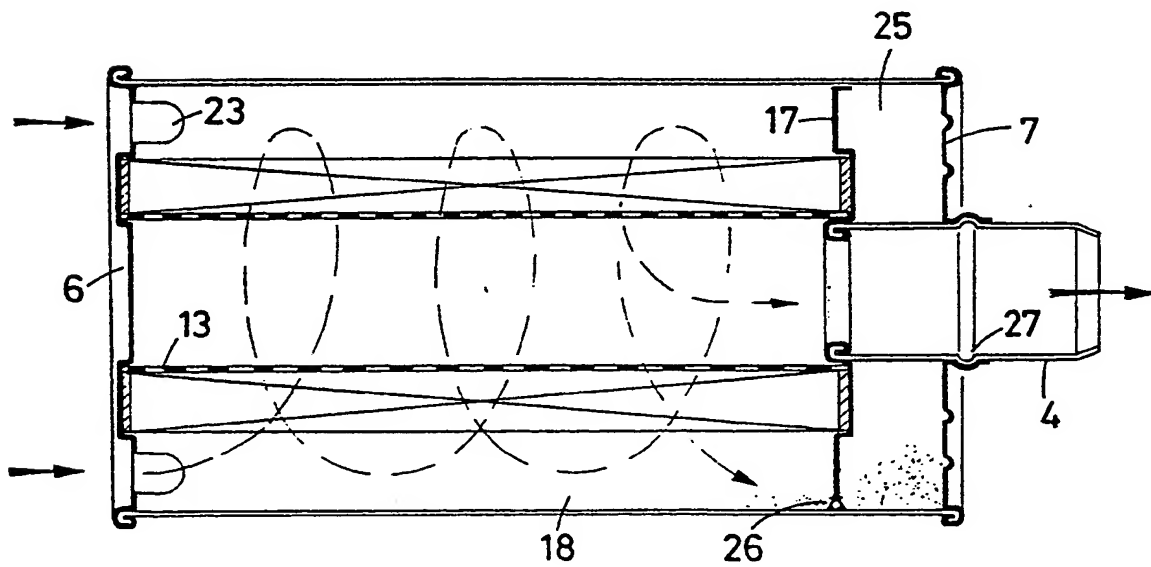


FIG.10



SPECIFICATION

Disp sabl air filt r

5 The present invention relates to air filters, used in particular on board land vehicles.

The manufacturing costs of such filters are affected by a certain number of conditions and factors which concern the long operating life required of this type of device:

- robustness of the body, to offer excellent mechanical strength;
- protection of the effective surface in order durably to resist corrosion, for example for the whole life of the vehicle which is fitted therewith;
- possibility of dismantling the elements constituting the filter to allow either the exchange of the filter cartridge inside the casing of the filter or, in the case of filters with centrifugal separation stage, the evacuation of the dust stopped by prefiltration;
- possibility of using so-called safety cartridges, to ensure the continuity of filtration whilst the main cartridge is being changed, this avoiding interrupting the protection of an internal combustion engine supplied with air via the filter.

All the elements of the filter (casing, main cartridge, safety cartridge, possible dust chamber) must, of course, be fixed independently. This necessity multiplies the number of parts and sealing elements, which thus increases the cost price.

It is an object of the present invention to provide an air filter designed to overcome these drawbacks. This air filter, which comprises, in a cylindrical casing, a coaxial annular filter cartridge, through which the air to be filtered passes radially from the outside towards the inside, is characterized in that it offers a non-dismountable structure, all the elements constituting its casing being assembled by crimping. Such a weld-less structure leads to a simple, robust, inexpensive air filter which is easy to manufacture and which is disposable when its functioning is no longer satisfactory, for example when it is clogged due to the accumulation of dust in its interior.

In a preferred embodiment, the casing of the filter comprises a tubular cylindrical body closed at its ends by two end plates, one of the end plates being pierced with at least one air inlet hole and the other end plate comprising an opening made at its centre and connected to an air outlet nozzle. All these metallic elements are advantageously made of previously protected sheet metal.

The filter cartridge is preferably gripped between two end plates fixed to the tubular body and its ends are hermetically joined, for example by gluing, to the inner faces of said end plates, one of the end plates, located on the inlet side, being pierced on its periphery with air inlet orifices opening into the space outside the filter cartridge, and the other end plate, located on the outlet side, comprising a central opening in coincidence with outlet nozzle, the latter being crimped on this end plate. Furthermore, the filter cartridge may be internally supported by a longitudinal open wall reinforcement extending from one of said end plates to the other and supported thereby.

It may be provided that at least one of the end plates gripping and supporting the filter cartridge is the end plate crimped at the corresponding end of the tubular body. If, on the one hand, this is not the case for that end plate gripping and supporting the filter cartridge which is located on the inlet side, this end plate is then a complementary end plate immobilised inside the tubular body at a short distance from the end plate crimped at the corresponding end of said body, the latter end plate bearing, in coincidence with an opening made at its centre, a crimped air inlet nozzle. If, on the other hand, this is not the case for that end plate gripping and supporting the filter cartridge which is located on the outlet side, this end plate is then a complementary end plate immobilised inside the tubular body at a short distance from the end plate crimped at the corresponding end of said body.

The air inlet orifices of the end plate bearing the filter cartridge on the inlet side may be gill openings oriented in the same gyratory direction which impart to the incoming air flow an vortex movement around the filter cartridge, this movement procuring a prefiltration by the centrifugal effect.

The complementary end plate added to the end plate crimped at the outlet end of the tubular body may be placed at some distance therefrom; it is pierced on the periphery with orifices allowing the dust stopped by the filter to leave the space surrounding the filter cartridge and to accumulate in the chamber located between said two end plates, the outlet nozzle and the tubular body. The more the volume of this dust retention chamber is large, the more the life of the filter is long.

The casing may be provided, at a low point, with an orifice for evacuating the dust stopped by the filter. This orifice may be provided with a valve which, open in rest position, closes under the effect of the depression occurring in the casing when the filter is functioning. This orifice may also be provided with a simple terminal element connected to a source of depression such as an air aspirator, said terminal element being preferably oriented tangentially with respect to the wall of the tubular body in order to participate in the creation of the vortex movement of prefiltration already mentioned, due to the air inlet gill openings inside the casing.

The filter cartridge may in any case be cylindrical, like its possible support reinforcement. However, it is preferably conical in shape, as this form (known per se by Applicants' French Patent No 1 563 990) improves the parameters of dimensioning of the whole of the filter by a better compromise between the necessary front passage surfaces and the filtering surfaces.

The invention will be more readily understood on reading the following description with reference to the accompanying drawings, in which:

Figs. 1 to 4 shows various embodiments of a filter according to the invention in axial section.

Figs. 5 and 6 show, in perspective and in section respectively, air inlet orifices made in the form of gill openings.

Figs. 7 and 8 show in axial section, to a larger scale, a part of a filter equipped respectively with a

valve and a dust evacuating terminal.

Fig. 9 schematically shows a filter according to Fig. 8 whose terminal is connected to air aspirator.

Figs. 10 and 11 show two further embodiments of a filter according to the invention, in axial section.

Referring now to the drawings, an air filter according to the invention is basically constituted (Fig. 1) by a casing 1 containing an annular filter cartridge 2; the air to be filtered penetrates into the casing 1 through orifices 3, passes through the filter cartridge 2, abandoning its dust outside or in said cartridge and emerges, purified, through a nozzle 4 communicating with the inner space of the filter cartridge 2.

The casing 1 is not dismountable and is exclusively composed of pieces assembled by crimping; more precisely, the contiguous edges of the pieces to be connected are rolled together, according to a technique well-known in the canning industry. These pieces comprise a cylindrical tubular body 5 and two circular end plates 6, 7 closing the ends of said tubular body. The latter is itself made from a pre-lacquered, pre-impressed, rolled and longitudinally clipped sheet. The periphery of the end plates 6, 7, made of protected sheet metal (tin-plate or zinc-plated sheet), is crimped on the body 5; the end plates grip the filter cartridge 2 which is disposed coaxially with respect to the general axis 8 of the filter (Fig. 2) and of which the ends fit in circular grooves made in the end plates 6 and 7. A tight connection between the cartridge 2 and the end plates 6, 7 is ensured either by gluing or by the arrangement of seals 9, for example made of polyurethane. The air inlet orifices 3 are made in the peripheral region of the end plate 6, whilst the end plate 7, pierced with a central opening, comprises the air outlet nozzle 4 fixed by crimping along the periphery of said opening.

The cartridge 2 is preferably supported internally by a cylindrical reinforcement which may be constituted either by a trellis work or netting 10 (Fig. 2a) or by longitudinal bars 11 (Figs. 2b), or by a helically wound metal wire 12 (Figs. 3a and 4a), or by a perforated tube 13 (Figs. 3b and 4b).

As may be seen in Fig. 3, the outlet end plate 7 may be divided into an end plate 7a bearing the cartridge 2 and crimped on the end of the outlet nozzle 4, and into an end plate 7b crimped on the end of the cylindrical body 5 and traversed by the nozzle 4, to which it is connected due to a rib 27. The end plates 7a and 7b are here applied against each other.

Fig. 4 shows a variant embodiment where the inlet end plate 6 does not support the filter cartridge 2. A complementary end plate 16 supports it and consequently comprises the above-mentioned air inlet orifices 3. The end plate 6, crimped on the body 5, is provided with a central opening on the edge of which is crimped an inlet nozzle 14. This embodiment is adopted for example when the air filter ensures air supply of an internal combustion engine of a vehicle and when it is desired for it to receive, not the air located beneath the bonnet of the engine, but air taken from the outside atmosphere. The inlet nozzle 14 then allows a connection by pipe to an outside air intake.

In this latter embodiment, the end plate 16 is immobilised in a groove 15 made in the cylindrical body 5. This groove, due to the longitudinal crimping of the body 5, cannot be continuous. Thus, the impression of the end plate 16 in the groove 15 is made only at a few points, since this connection may be made without taking tightness into consideration, its purpose only being to avoid any beat of the end plate 16 under the action of the pressure pulsations of the air.

The filters described up to now are simple filters. If it is desired to obtain a prefiltration of the air by centrifugal effect, it suffices to provide in the end plate 6 or 16 supporting the cartridge 2 on the inlet side, as orifices 3, gill openings 23 (Figs. 5 and 6) oriented in the same gyratory direction, which impart to the incoming air an eddying movement around the filter cartridge 2 (cf. Figs. 10 and 11). The large-particle dust then accumulates, under the action of the centrifugal force, along the body 5 near the end plate 7, this increasing the life of the filter cartridge 2. This dust may be evacuated (Fig. 7) by a rubber valve 24 of known type, disposed at a low point on the end plate 7 or on the body 5 and comprising two supple lips which, parted at rest, close under the effect of the depression occurring in the space 18 upstream of the filter cartridge 2. The valve 24 therefore ensures exaccuation of the stopped dust and the tightness of the casing in the course of functioning of the filter.

The evacuation of the dust may be considerably improved by providing the body 5 or the end plate 7 with a connection terminal 19 (Fig. 8) instead of with a valve 24, a suction pump being connected to said terminal. Said pump is advantageously a air aspirator 20 (Fig. 9) disposed in the exhaust manifold 21 of an internal combustion engine 22 with which the filter is associated.

The yield of a filter thus equipped is clearly greater, with or without centrifugal effect. In the first case, it may be further improved by no longer disposing the terminal 19 perpendicularly, but tangentially to the wall of the cylindrical body 5, in the appropriate direction, this disposition increasing the energy of the eddy formed by the air circulating around the cartridge 2 under the action of the gill openings 23 and consequently improves the effect of centrifugal separation. This arrangement has not been shown.

In the cases on no evacuation of the dust being provided and if it is considered that the dust retaining capacity of the body of the filter is insufficient, a complementary endplate 7 may be associated with the outlet end plate 7 (Fig. 10), said complementary end plate having a central opening to which the outlet nozzle 4 is connected by crimping, so as to create between the end plates 7 and 17, the nozzle 4 and the body 5 a dust retention chamber 25 communicating with the space 18 through openings 26 pierced in the end plate 17. The chamber 25 may offer a relatively large volume, ensuring long life for the filter before it must be discarded. The end plate 7 is here not connected by crimping to the nozzle 4; it is simply engaged on a rib 27 provided on said nozzle, as in the example of Fig. 3.

It is obvious that all the embodiments which have just been described with use of a cylindrical filter cartridge may be adapted to the advantageous use of a conical cartridge. Fig. 11 shows an embodiment corresponding to the embodiment of Fig. 4, half *b*, but comprising a conical filter cartridge 2 (as well as inlet end plate 16 with gill openings 23 and an evacuation valve 24 according to Figs. 5 to 7.

CLAIMS

1. An air filter, comprising, in a cylindrical casing, a coaxial annular filter cartridge through which the air to be filtered passes radially from the outside towards the inside, this filter having a non-dismountable structure and all the elements constituting its casing being assembled by crimping.

2. A filter as claimed in Claim 1, wherein the casing comprises a cylindrical tubular body closed at its ends by two end plates, one of the end plates being pierced with at least one air inlet hole and the other end plate comprising an opening made at its centre and connected to an air outlet nozzle.

3. A filter as claimed in Claim 2, wherein the filter cartridge is gripped between two end plates fixed to the tubular body and its ends are hermetically connected to the inner faces of said end plates, one of the end plates being pierced on its periphery with air inlet orifices opening into the space outside the filter cartridge, and the other end plate comprising a central opening in coincidence with the outlet nozzle, the latter being crimped on this end plate.

4. A filter as claimed in Claim 3, wherein the filter cartridge is internally supported by a longitudinal open wall reinforcement, extending from one of said end plates to the other and held thereby.

5. A filter as claimed in Claim 3 or 4, wherein at least one of the end plates gripping and supporting the filter cartridge is the end plate crimped at the corresponding end of the tubular body.

6. A filter as claimed in any one of Claims 3 to 5, wherein the end plate gripping and supporting the filter cartridge located on the inlet side is a complementary end plate immobilised inside the tubular body at short distance from the end plate crimped at the corresponding end of said body, the latter end plate bearing a crimped air inlet nozzle in coincidence with an opening made at its centre.

7. A filter as claimed in any one of Claims 3 to 6, wherein the end plate gripping and supporting the filter cartridge located on the outlet side is a complementary end plate immobilised inside the tubular body at short distance from the end plate crimped at the corresponding end of said body.

8. A filter as claimed in any one of Claims 3 to 7, wherein the air inlet orifices are gill openings oriented in the same gyratory direction which impart to the incoming air flow an vortex movement around the filter cartridge.

9. A filter as claimed in Claims 7 and 8, wherein the complementary end plate is placed at same distance from the end plate crimped at the outlet end of the tubular body and is pierced on its periphery with orifices allowing the dust stopped by the filter to accumulate in the chamber appearing between said two end plates.

10. A filter as claimed in Claim 8, wherein the

casing is provided, at a low point, with an orifice for evacuating the dust stopped by the filter.

11. A filter as claimed in Claim 10, wherein said orifice is provided with a valve which, open in rest position, closes under the effect of the depression occurring in the casing when the filter is functioning.

12. A filter as claimed in Claim 10, wherein said orifice is provided with a terminal connected to a source of depression such as a air aspirator.

13. A filter as claimed in Claim 12, wherein said terminal is oriented tangentially to the wall of the tubular body.

14. A filter as claimed in any one of Claims 1 to 13, wherein the filter cartridge and its possible support reinforcement are cylindrical.

15. A filter as claimed in any one of Claims 1 to 13, wherein the filter cartridge and its possible support reinforcement are conical.

16. An air filter substantially as described hereinabove and illustrated in the accompanying drawings.

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